

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<b>Applicant:</b>	Nakas et al.	<b>Conf. No.:</b>	8887
<b>Serial No.:</b>	10/528,923	<b>Art Unit:</b>	1652
<b>Filing Date:</b>	03/23/2005	<b>Examiner:</b>	Prouty, Rebecca E.
<b>Title:</b>	BIOCONVERSION OF XYLAN AND LEVULINIC ACID TO BIODEGRADABLE THERMOPLASTICS		
<b>Docket No.:</b>	SUNY-0004-US		

Mail Stop Appeal Brief – Patents  
Commissioner for Patents  
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### BRIEF OF APPELLANT

This is an appeal from the Final Office Action dated February 8, 2008 rejecting claims 1, 3-7, 9, and 18. This Brief is accompanied by the requisite fee set forth in 37 C.F.R. 1.17 (c).

### REAL PARTY IN INTEREST

The Research Foundation of the State University of New York is the real party in interest.

### RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

### STATUS OF CLAIMS

As filed, this case included claims 1-17. In response to a restriction

requirement dated August 23, 2007, Applicant filed on November 21, 2007 an election of claims 1-9, withdrawal of claims 10-17, and addition of new claim 18. Claims 1, 3, 9, and 18 were previously amended. Claims 2 and 8 were previously canceled. Claims 1, 3-7, 9-18 remain pending. Claims 1, 3-7, 9, and 18 stand rejected and form the basis of this appeal.

### **STATUS OF AMENDMENTS**

A Final Office Action was issued by the Office, dated February 8, 2008, in response to an Amendment that was filed on November 21, 2007 by Appellant. An Advisory Action was issued by the Office dated April 18, 2008 in response to an After-Final Amendment that was filed on March 27, 2008. The After-Final Amendment was entered. In response to the Advisory Action, a Notice of Appeal and Pre-Appeal Brief Conference Request were filed on May 7, 2008. A Notice of Panel Decision from Pre-Appeal Brief Review was issued dated August 4, 2008.

### **SUMMARY OF CLAIMED SUBJECT MATTER**

The invention comprises the use of xylose as a primary carbon source, and levulinic acid as a secondary carbon source, or co-substrate, for microbial fermentation to produce PHAs. The invention therefore pertains to methods of producing PHAs by microbial fermentation as well as to the PHAs so produced.

Claim 1 claims a process for producing a polyhydroxyalkonate (PHA) co-polymer comprising 3-OH-valeryl (3-HV) and 3-OH-butyryl (3-HB) monomers

(¶[0012]) which comprises: adding to a medium containing a microorganism that converts carbon to PHA primary carbon source (¶[0022]) and a first quantity of levulinic acid as a secondary carbon source (¶[0029]); adding a second quantity of levulinic acid to the medium between about 16 hours and about 24 hours after the first quantity of levulinic acid is added (¶[0029]), wherein the second quantity of levulinic acid is greater than the first quantity of levulinic acid (¶[0030]).

### **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

1. Whether claims 1, 3-7, 9, and 18 are unpatentable under 35 U.S.C. 103(a) over the combination of Lee, Ramsay et al., Bertrand et al., Chung et al. and Jang et al.

### **ARGUMENT**

In the Final Office Action, Claims 1, 3-7, 9 and 18 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over the combination of Lee, Ramsay et al., Bertrand et al., Chung et al. and Jang et al.

Specifically the Office asserts that each of Lee, Ramsay et al., and Bertrand et al. teach the production of the polyhydroxyalkanoate PHB with a microorganism using xylose as the main carbon source.

The Office admits that each of Lee, Ramsay et al., Bertrand et al. do not teach the use of levulinic acid (LA) as a cosubstrate for the production of P(3HB-co-3HV).

The Office asserts that each of Chung et al. and Jang et al. teach the

production of the polyhydroxyalkanoate P(3HB-co-3HV) with a microorganism using glucose as a primary carbon source and LA as a secondary carbon source.

The Office admits that Chung et al. teaches the addition of additional amounts of LA to the culture to maintain the level of LA in the culture at a constant amount.

Upon these five references, the Office concludes it would have been obvious to the skilled artisan to produce the polyhydroxyalkanoate P(3HB-co-3HV) with a microorganism using xylose as a primary carbon source and LA as a secondary carbon source with a second addition of LA to the culture between 16 to 24 hours after the first quantity of LA was added where the second addition of LA is greater than the first quantity of LA.

Applicants respectfully assert, however, that the Office has failed to establish a case of *prima facie* obviousness under 35 USC 103(a). "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). Applicant respectfully asserts no convincing line of reasoning from the five references cited to Applicant's invention has been presented by the Office.

Regarding the Office's citation to five references, Applicants respectively assert that it would not have been obvious at the time of the invention, to have

modified and combined these five references as suggested by the Office. It is the Applicants' position that, absent their own teachings, the Office's rejection is legally and logically untenable.

Applicant asserts that the addition of a first quantity of LA as a secondary carbon source and an additional second quantity of LA at 16 to 24 hours after the first quantity was added in an amount greater than the first quantity is non-obvious.

Bertrand et. al teaches the addition of propionic acid (PA) as a secondary carbon source. Bertrand et al. does not teach a two-stage addition of the secondary carbon source with the second addition being in a quantity greater than the first. Lee and Ramsay et al. do not teach the addition of a secondary carbon source at all, let alone the addition of a secondary carbon source in a two-stage addition with the second addition being greater than the first. The Office admits that neither Lee, Ramsay et al., nor Bertrand et al. teach the use of LA as a cosubstrate for the production of the copolymer.

Jang et al. teaches the addition of LA as a secondary carbon source but does not teach the subsequent addition of LA to the culture after the first addition of LA. Chung et al. teaches the use of LA as a secondary carbon source and teaches the use of additional amounts of LA to maintain the level of LA in the culture at a constant amount. In other words, Chung et al. teaches maintaining the level of the secondary carbon source – not increasing the level. Applicants assert, therefore, that Chung et al. explicitly teach away from the claimed invention.

Applicants note that each of Lee, Ramsay et al., Bertrand et al., Chung et al. and Jang et al. do not teach the addition of a first and second quantity of a secondary carbon source with the second quantity being greater than the first quantity.

Adding a second quantity of LA 16 to 24 hours subsequent to a first quantity added is not taught or suggested by the cited references in any combination.

Further, neither Chung et al. nor Jang et al. teach or suggest the use of xylose as a primary carbon source. Chung et al. mention several sugars (glucose, sucrose, and sorbitol) as possible carbon sources for the production of the 3HB-co-3HV copolymer using LA as a secondary carbon source. Jang et al. only mention the use of glucose to produce the copolymer. As noted by Bertrand et al., not all sugars are suitable carbon sources (see, e.g., Bertrand et al. at 3136, discussing the unsuitability of lactose as a carbon source).

Finally, none of the cited references provides the suggestion or motivation to combine or modify the teachings of any other cited reference and the Office fails to provide any such reason. In addition, given the respective teachings of each of the cited references, Applicants assert that such a suggestion or motivation to combine or modify the teachings of the cited references cannot be found in the knowledge of one having ordinary skill in the art.

Applicants respectfully assert that none of the rejected claims is obvious in view of any combination of Lee, Ramsay et al., Bertrand et al., Chung et al., or Jang et al.

## CONCLUSION

In summary, Appellant submits that claims 1, 3-7, 9, and 18 are allowable because the claimed invention is patentable over the combination of Lee, Ramsay et al., Bertrand et al., Chung et al. and Jang et al.

Respectfully submitted,

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## CLAIMS APPENDIX

1. A process for producing a polyhydroxyalkonate (PHA) co-polymer comprising 3-OH-valeryl (3-HV) and 3-OH-butyryl (3-HB) monomers which comprises

adding to a medium containing a microorganism that converts carbon to PHA primary carbon source and a first quantity of levulinic acid as a secondary carbon source;

adding a second quantity of levulinic acid to the medium between about 16 hours and about 24 hours after the first quantity of levulinic acid is added,

wherein the second quantity of levulinic acid is greater than the first quantity of levulinic acid.

3. The process of claim 1 in which the xylose is derived from the xylans present in hemicellulose.

4. The process of claim 3 in which the hemicellulose is derived from forest biomass.

5. The process of claim 3 in which the levulinic acid is derived from organic waste.

6. The process of claim 4 in which the levulinic acid is derived from forest biomass.



7. The process of claim 1 in which the ratio of HV to HB is modulated by adjusting the ratio of xylose to levulinic acid.
9. The process of claim 1 in which the ratio of xylose to levulinic acid in the medium after the second quantity of levulinic acid is added ranges from about 0.01 to about 1.0.
18. The process of claim 1, wherein the second quantity of levulinic acid is added about 20 hours after the first quantity of levulinic acid was added.

## **EVIDENCE APPENDIX**

No evidence has been submitted.

## **RELATED PROCEEDINGS APPENDIX**

There are no related proceedings.